

Characterization of historic mortars for compatible restoration – Case study of South Africa

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ABSTRACT

The history of the South African construction industry dates as far back as the seventeenth century, with the most iconic buildings such as the Castle of Good Hope (1666), Slave Lodge (1679), Robben Island (1700s), Union Buildings (1913), memorials and cathedrals. These structures represent the political, slavery, democracy and religious history of South Africa and its development throughout the years. They stand out from the rest of the modern constructions as they portray marvellous designs and special materials used for their construction. However, some of the historic structures show critical signs of deterioration which threaten their existence. In an attempt to rescue these national treasures, the use of Portland cement has been a common practice. The application of incompatible materials is said to accelerate the deterioration and endanger the authenticity of these monuments. The lack of understanding of the original material behaviour has seen several restoration projects result in disaster because of the application of incompatible materials. For developing countries, South Africa in particular, this approach has undoubtedly impacted negatively on the economy as repeated repairs are necessary.

In order to practice compatible restoration, characterisation of the original cementing materials has been found to be the key. This work provides a detailed procedure to establish the properties of the original materials. The results of an experimental investigation into the physical, chemical and mineralogical properties of the original materials from the Castle of Good Hope and Robben Island; South Africa is presented. A standard affordable methodology for characterisation of original historic cementing materials using the optimum tests is proposed. The methodology identifies the constituents (binder, aggregates, additives) of the original mortar without the use of costly equipment or expertise.

The results from the laboratory experiments were analysed for their competence to provide useful data at minimal costs. Thereafter, a standard protocol was developed, incorporating the procedure for sampling, and preparation of the sample, material analysis and documentation. The standard protocol includes the cohesion test, visual investigation and titration test for analysis of the salts and metal oxides present in the materials. These tests provide the relevant data for the production of replica repair materials. The standard protocol will be useful for local heritage authorities as it could be incorporated into the conservation management plans prior to restoration works. This will ensure compatible and sustainable restoration of historic buildings not only in South Africa, but around the world.

Key words: South Africa, historic buildings, material characterization, standard protocol, restoration